Developmental Standard – The middle childhood teacher understands that the developmental changes that occur in children in middle childhood are more radical than those for any other age group. These teachers understand, and use the major concepts, principles, theories, and research related to the development of children and young adolescents to construct learning opportunities that support individual students' development, acquisition of knowledge, and motivation.

Teacher Preparation Standard

NUMBER SENSE

Teachers of mathematics understand

- estimation
- reasonableness of results
- the use of number concepts, operations, and properties
- basic number theory
- the role of algorithms
- place value
- how to extend the number systems from the whole numbers to fractions and integers
- rational and real numbers
- discussion of the extension of the operations, properties, and ordering
- notions of fractions, decimals, percents, ratio, and proportion

Student Academic Standards

GRADE 4	GRADE 5	GRADE 6
NUMBER SENSE • place value system to count, read, and write whole numbers up to 1,000,000 • decimals to two places • order and compare whole numbers < > • concept of fractions to mixed numbers • how fractions are related to whole numbers • extend skills with decimals and how they relate to fractions	**NUMBER SENSE** • magnitudes of numbers rounding whole numbers and decimals to any place value • order and compare whole numbers and decimals < > • percentage as parts of a hundred • compare different ways to looking at fractions • identify whole numbers as prime or composite • compare fractions, decimals, and mixed numbers on a number line	**NUMBER SENSE** • understanding of the relationship between fractions and decimals • extend the number system to include negative numbers • relate percentages to fractions and decimals • learn how to use rations • find multiples and factors of whole numbers • use multiples and factors to solve problems involving fractions

Teacher Preparation Standard

FUNCTIONS AND USE OF VARIABLES

Teachers of mathematics understand

- development of mathematical language and symbolism
- how mathematical language and symbolism have influenced the way we communicate mathematical ideas
- experience in representing and solving problems requiring the use of variables
- basic concepts of functions and their use in the growth of mathematical ideas
- different representations of functions (tabular, graphical, symbolic, verbal)
- how to move among these representations
- the strengths and limitations of each representation
- the distinction between continuous and discrete approaches in the solution of mathematical problems

Student Academic Standards

GRADE 4	GRADE 5	GRADE 6
COMPUTATION • fluency in computation • learn about numbers • learn how to add, subtract, multiply, and divide • understand the special roles of 0 and 1 in multiplication and division • add and subtract fractions and decimals, • learn how these different representations of numbers can be manipulated	**COMPUTATION** • extend the standard methods for multiplying and diving to larger numbers • add and subtract more complex fractions and decimals • learn how different representations of numbers can be manipulated • develop an understanding of how to multiply and divide fractions	**COMPUTATION** • add, subtract, multiply, and divide fractions, decimals, and both positive and negative integers • solve problems using ratios, proportions, and percentages, • calculate discount and interest • use mental arithmetic and subtract simple fractions and decimals

Teacher Preparation Standard

NUMBER SYSTEMS AND ALGEBRAIC STRUCTURES

Teachers of mathematics understand

- The system of real numbers should be extended to complex numbers
- investigations of selected algebraic structures
- concrete examples such as clock arithmetic, modular systems, and matrices
- properties of the operation in these structures
- investigation of how these structures are reflected in the number systems of school mathematics
- use of matrices and matrix operations to record information and to deal with solutions of systems of equations

Student Academic Standards

GRADE 4	GRADE 5	GRADE 6
ALGEBRA • develop an understanding of the fundamental concept of a variable • use a letter to represent all numbers of a certain kind • write formulas and equations with letter representation • understand equations that give the rule for a function • number patterns involving multiplication and division • recognize and apply the relationships among the four operations of addition, subtraction, multiplication, and division • develop the connection between numbers and number lines, • estimating positions on a number line	**ALGEBRA AND FUNCTIONS** • develop further the fundamental concept of a variable • use a letter to stand for all numbers of a certain kind • write simple algebraic expressions • evaluate simple algebraic expressions • begin to develop the idea of linking an algebraic equation to a graph • finding ordered pairs that fit a linear equation • plotting ordered pairs as points on a grid, and drawing the resulting straight line • interpret graphs to answer questions	**ALGEBRA AND FUNCTIONS** • write and solve simple equations and inequalities • write and use formulas to solve problems • use parentheses in more complex expressions to show the order of operations • extend graphs of straight lines to include negative values

Teacher Preparation Standard

GEOMETRY

Teachers of mathematics

- understand how geometry is used to describe the world in which we live
- use geometry can be used to solve real-world problems
- analyze two-and three-dimensional figures
- include the study of tessellations, symmetry, polygons, polyhedra, and curved shapes
- use synthetic, coordinate, and transformational geometry
- solve problems and hone skills in building justifications and coherent arguments for the plausibility of conjectures
- emphasize spatial visualization

Student Academic Standards

GRADE 4	GRADE 5	GRADE 6
GEOMETRY • identify, describe, and draw such concepts as acute angles and parallel lines • describe shapes and objects, including special quadrilaterals (rhombuses and trapezoids) • identify congruent quadrilaterals and explain their reasoning using specific geometric terms • draw lines of symmetry for various polygons, • construct cubes and prisms • develop ability to work in three dimensions	**GEOMETRY** • draw angles, parallel and perpendicular lines • identify radius and diameter of circles • describe geometric shapes, using ruler, compass, protractor, and computer drawing programs • identify congruent triangles • explain congruent triangle reasoning using specific geometrical terms • understand and use terms such as equilateral, isosceles, acute, and obtuse • classify polygons with five or more sides • develop an understanding of reflectional and rotational symmetry • construct prisms and pyramids • develop an ability to work in three dimensions	**GEOMETRY** • draw special types of angles and use them to solve problems • find and use the sum of the angles of a triangle and of a quadrilateral • identify shapes that are similar (the same shape but necessarily the same size) • draw reflections and translations of shapes • draw two-dimensional views of three-dimensional shapes

Teacher Preparation Standard

MEASUREMENT

Teachers of mathematics understand

- measurement needs to be understood from the perspective of its historical development
- attributes of what we measure include length, area, volume, capacity, time, temperature, angles, weight, and mass
- understand that the units to record measure are different from the process of measurement itself
- ideas are reinforced through varied experience, using both standard and nonstandard units
- learn to estimate lengths, areas, etc.
- the System International d'Units (the metric system)
- derivations of the formulas for the perimeter, area, and volume of common figures should be approached through meaningful explorations
- indirect measurement and its many applications should be studied

Student Academic Standards

GRADE 4	GRADE 5	GRADE 6
MEASUREMENT • measure length to the nearest eighth-inch • measure length to the nearest millimeter • subtract units of length • develop and use the formulas for calculating perimeters and areas of rectangles • compare the concepts of volume and capacity • add time intervals • calculate the amount of change from a purchase	**MEASUREMENT** • develop and see the formulas for calculating perimeters and areas of triangles, parallelograms, and trapezoids • extend these ideas to finding the volume and surface area of rectangular solids • understand and use additional units for measuring weight: ounce, gram, and ton • add and subtract with money in decimal notation.	**MEASUREMENT** • measure in order to compare lengths, areas, volumes, weights, times, temperatures, etc. • learn about the number π and use it to calculate the circumference and area of circles • construct models, find the volume and surface area of prisms and cylinders • convert temperatures between Celsius and Fahrenheit.

Teacher Preparation Standard	Student Academic Standards		
	GRADE 4	GRADE 5	GRADE 6
PROBLEM SOLVING Teachers of mathematics understand Questioning techniques,* which include • Discovery • Reasoning processes • Alternative strategies • Technology • Reflective processes • Analysis and justification • Formulating the problem *refer to Teachers of Mathematics Standard #4 for more detail	**PROBLEM SOLVING** • choose how to approach a problem • explain the reasoning, and they check results • develop skills with numbers, geometry, or measurement • move from simple ideas to more complex ones by taking logical steps that build a better understand of mathematics	**PROBLEM SOLVING** • choose how to approach a problem • explain the reasoning, and check results • develop skills with algebra, geometry, or measurement • move from simple to more complex ideas by taking logical steps that build a better understanding of mathematics	**PROBLEM SOLVING** • choose how to approach a problem • explain the reasoning, and they check results • develop skills with negative numbers, calculating angles, or finding areas • move from simple to more complex ideas by taking logical steps that build a better understanding of mathematics
STATISTICS AND PROBABILITY Teachers of mathematics understand • variety of experiences in the collection, organization, representation, and analysis, and interpretation of data • measures of central tendency, measures of variation (range, standard deviation, interquartile range, and outliers), and general distributions	**DATA ANALYSIS AND PROBABILTY** • Represent data on a number line and in tables, including frequency tables • Interpret data graphs to answer questions about a situation	**DATA ANALYSIS AND PROBABILITY** • Explain which types of displays are appropriate for various sets of data • Find the mean, median, mode, and range of a set of data which describe what each does and does not tell about the data set. • Understand that probability can take any value between 0 and 1. • Express outcomes of experimental probability	**DATA ANALYSIS AND PROBABILITY** • Organize and display single-variable data • Make frequency tables for numerical data • Compare the mean,median and mode for a set of data • Show all possible outcomes for compund events • Use data to estimate the probability of future events • Understand and represent probabilities as ratios, decimals and percentages